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Remarks/Arguments

The Office Action dated February 27, 2004, has been noted, and its contents carefully studied. In light of the amendments to the claims made herein, reconsideration of the rejection under 35 U.S.C. §102 and §103 is courteously requested.

In order to facilitate the Examiner's reconsideration, a brief discussion of the invention as now set forth in the amended claims, is presented herein.

More specifically, in one aspect, the invention relates to a method for synchronizing a plurality of data images in a computer system. The data images include a primary image and at least one secondary image. In operation, a write request from a host computer is received at a primary site and at a secondary image site. Writing to the primary image at the primary image site and attempting to write to the at least one secondary image at the at least one secondary image site occurs. In the event the write attempt to the at least one secondary image fails, there is created a fracture log at the primary image site. The fracture log as now recited in the claims is made up of a bit map of the change regions that have been effected in at least one disk containing the primary image, and which is representative of the blocks on the primary image which have changed at the primary image site.

Similarly, in another aspect, the method relates to a computer system for maintaining a plurality of data images in a computer system. The data images include a primary image and at least one secondary image. The system includes non-volatile storage for storing at least a primary image and a network interface for accessing the at least one secondary image. Logic is provided for creating a fracture log made up of a bitmap of the changed regions that have been effected on at least one disk containing the primary image, and which is representative of the blocks on the primary image which have changed at the primary image site.

Support for the noted amendments is found on paragraph 32 of the application. It is respectfully urged that the invention as now recited in the claims, is not anticipated under 35 U.S.C. §102 or obvious under 35 U.S.C. §103 from the cited references, in particular the sole applied reference, as will become more evident from the following discussion of the reference which is presented herein for the Examiner's kind consideration.

U.S. Patent No. 6,044,444 to Ofek

U.S. Patent No. 6,044,444 to Ofek (hereinafter "Ofek") discloses two data storage systems which are interconnected by data link for remote mirroring of data. Each volume of data is configured as local, primary in a remotely mirrored volume pair, or secondary in a remotely mirrored volume. The system controls the copying of primary data to a secondary storage system controller which forms part of a secondary storage system for providing a backup copy of the primary data.

In this regard, the system of Ofek relates to backing up or mirroring data on a secondary data storage system which is located at a second site which is geographically removed from the first site. For purposes of the disclosure therein, geographically removed means not within the same building as the primary data system. This is contrasted to the then known data processing systems which provide data mirroring to physically different storage systems which are generally within the same building. As such, the system of Ofek is a completely different environment to that of the present invention which relates generally to computer storage systems providing mirroring in distributed computer storage systems.

Turning now to the section of the patent cited by the Examiner to reject the claims under 35 U.S.C. §102 and §103, it is respectfully urged that the interpretation of the teachings of Ofek has been done in an impermissible hindsight manner after knowledge of Applicants' claimed invention. More specifically, in accordance with the teachings of Ofek, a record is kept of tracks which have not been written to at the secondary site when a failure to write to the secondary site occurs while writing to the primary site is occurring. When the ability to write is restored, the track from the primary is copied to the secondary to resynchronize the primary with the secondary. In this regard, it is important to appreciate that what is copied is the entire track from the primary to the secondary.

In contrast, Applicants' invention provides for creation of a fracture log which is made up of a bitmap of the change regions that have been effected on at least one disk containing the primary image. The bitmap is representative of the blocks on the primary image which have changed at the primary image site, as contrasted to the tracks. It is important to appreciate this distinction because in copying an entire track, Ofek provides a system similar to that of the prior

art which as discussed in Applicants' description of the invention, in one aspect provides for copying the entire primary image to all the secondary storage units, and which can take a significant amount of time depending on the image size. Similarly, a track on a disk contains a substantial amount of information some of which may not need to have been copied because the information on the secondary image corresponds exactly to that on the primary image, and which could result in substantial delays in re-synchronizing the two disks. In contrast, Applicants' invention provides for only copying blocks which have changed.

As may be appreciated by the Examiner, block storage is normally abstracted by a file system for use by programs and end users, and refers to the direct access to random disk blocks in disk storage. Further, blocks generally relate to data and files, whereas a track generally refers to an actual physical portion of a disk, as is shown in the appended documents which describe briefly what constitutes a track and what constitutes a block. Thus, Applicants' invention provides for copying substantially less information and execution of backing up of the secondary image site in a much faster and efficient manner than that disclosed or suggested by Ofek.

Further, when tracks are being copied the entire track is frozen until copied and no operations affecting the track can be conducted. In contrast, when blocks are operated on, only the specific block being operated on is affected and a user can work on other blocks on the storage. This is a fundamental principle of operation of operating systems.

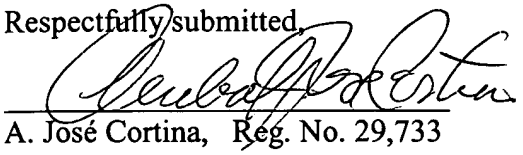
The remaining references have been studied and are not believed to be any more relevant to the claimed invention than that which has been applied to reject the claims.

Thus, for the foregoing reasons, it is respectfully urged that the claimed invention is not anticipated or obvious from the cited references. Accordingly, it is courteously requested that the application is now amended and be passed to issuance.

Nonetheless, should the Examiner have any comments, questions or suggestions of a nature necessary to expedite prosecution of the application, or to place the case in condition for allowance, she is courteously requested to telephone the undersigned at the number listed below.

Dated: May 27, 2004

Respectfully submitted,



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Enclosures

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lock storage

om Wikipedia, the free encyclopedia.

lock storage refers to the direct access to random disk blocks in computer disk storage. Block storage is normally abstracted by a file system for use by programs and end users.

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All magnetic disks are similarly **formatted**, or divided into areas, called

tracks

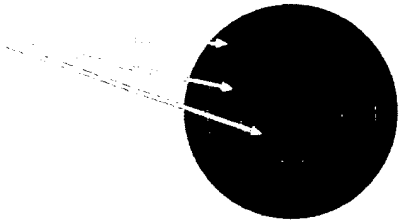
sectors

cylinders

The formatting process sets up a method of assigning addresses to the different areas. It also sets up an area for keeping the list of addresses. Without formatting there would be no way to know what data went with what. It would be like a library where the pages were not in books, but were scattered around on the shelves and tables and floors. You'd have a hard time getting a book together. A formatting method allows you to efficiently use the space while still being able to find things.

Tracks

A **track** is a circular ring on one side of the disk. Each track has a number.
The diagram shows 3 tracks.



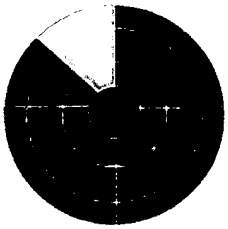
Sectors

A **disk sector** is a wedge-shape piece of the disk, shown in yellow. Each sector is numbered.

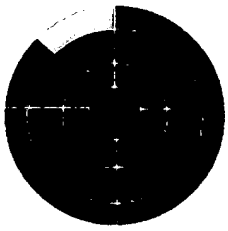
On a 5¼" disk there are **40** tracks with 9 sectors each.

On a 3½" disk there are **80** tracks with 9 sectors each.

So a 3½" disk has twice as many named places on it as a 5¼" disk.

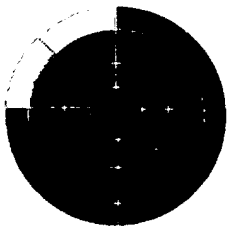


A **track sector** is the area of intersection of a track and a sector, shown in yellow.



Clusters

A **cluster** is a set of track sectors, ranging from 2 to 32 or more, depending on the formatting scheme in use.



The most common formatting scheme for PCs sets the number of track sectors in a cluster based on the capacity of the disk. A 1.2 gig hard drive will have clusters twice as large as a 500 MB hard drive.

1 cluster is the **minimum space** used by any read or write. So there is often a lot of **slack space**, unused space, in the cluster beyond the data stored there.

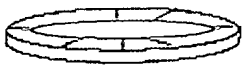
There are some new schemes out that reduce this problem, but it will never go away entirely.

The only way to reduce the amount of slack space is to reduce the size of a cluster by changing the method of formatting. You could have more tracks on the disk, or else more sectors on a track, or you could reduce the number of track sectors in a cluster.

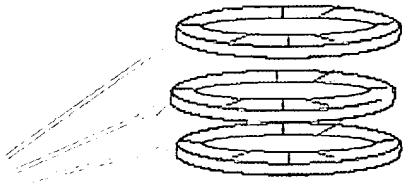
Cylinders

A **cylinder** is a set of matched tracks.

On a double-sided *floppy*, a track from the top surface and the same # track from the bottom surface of the disk make up a cylinder. The concept is not particularly useful for floppies.



On a *hard disk*, a cylinder is made of all the tracks of the same # from all the metal disks that make up the "hard disk". If you put these all together on top of each other, you'd have something that looks like a tin can with no top or bottom - a cylinder.

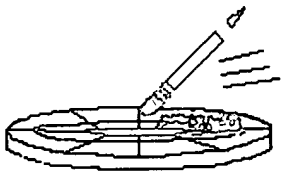


The computer keeps track of what it has put where on a disk by remembering the addresses of all the sectors used, which would mean remembering some combination of the cylinder, track, and sector. Thank goodness we don't have to remember all these numbers!

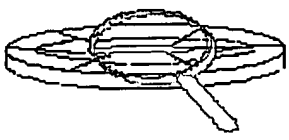
Where the difference between addressing methods shows up is in the time it takes for the read/write head to get into the right position. The cylinder method writes data down the disks on the same cylinder. This works faster because each metal platter has a read/write head for each side and they all move together. So for one position of the read/write heads, the computer can put some data on all the platters before having to move the heads to a new position.

What happens when a disk is formatted?

1. All data is *erased*.
   Don't forget this!!



2. *Surfaces* are *checked* for physical and magnetic defects.



3. A *root directory* is created to list

where things are on the disk.

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Want to help?

~~ 1 Cor. 10:31 ...whatever you do, do it all for the glory of God. ~~

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